Image Management System in Ophthalmology

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INTRODUCTION

Ophthalmology is one of the more technology dependent specialties in medicine and is ripe for innovation. In the Ophthalmology Department at Naval Medical Center San Diego (NMCSD), over 15 imaging devices are used daily to capture diagnostic images for patient care. These diagnostic data are vital in the decision-making process to improve or prevent vision loss. In addition, the integration of an electronic health record system has provided many benefits; however, challenges remain with integrating images from diagnostic devices into the record. Without an image management system (IMS), providers must leave the examination room and review images away from the patient at each device, separately. Many of these devices are located in different rooms throughout the clinic due to size and space requirements. This leads to significantly decreased efficiency, delays in patient care and a disrupted patient visit.

Several IMS devices are available that allow integration of images and information from various instruments into a single, secure, digital environment. These systems provide an infrastructure that allows physicians to view, organize and edit the information and images at a single computer location in the exam room, while increasing efficiency, increasing the quality of patient care and improving the coordination of care among multiple treatment facilities.

Prior to the recent implementation of an IMS in our department, diagnostic data provided by each imaging device were difficult and time-consuming to review. Each provider had to review images at each device independently when the device was not being used for patient care. Alternatively, a printout of the data was made available to the provider. The printout was not editable and not easily integrated into an electronic health record without high resolution scanning. The objectives of implementing an IMS were to use existing sustainable technology to improve efficiency and delivery of patient care by utilizing an adaptable secure data backup system that also provides a cost-savings to our command.

Improved efficiency and cost savings would also come from eliminating daily tasks, such as scanning image printouts and preparing shadow records, allowing the ancillary staff to provide more time in direct patient care related activities. Since the integration of an IMS, there has been a decrease in operating expenses, streamlined patient care visits, improved coordinated care between providers at different treatment areas and facilities and improved overall morale amongst the providers and ancillary staff.

METHODS

To investigate the impact an IMS would have for our clinic, we reviewed a typical week of patient visits. During this time period, 233 different studies were performed that would be captured by an IMS, including over 90 optical coherence tomography studies, 63 visual field tests and 75 color photographs. We subsequently calculated the time savings generated due to improved efficiency per patient visit for the provider. In addition, we calculated the cost savings due to a decreased use of consumables and decreased reliance on ancillary staff for paper records preparation and document scanning.

Various 'out-of-the-box' IMSs were investigated. Factors such as maintenance of data security, ease of accessibility, proven reliability, adaptability to integrate a variety of devices, simplicity of interface, cost and customer support were important in the decision-making process. Through the support of our command and our Information Technology (IT) Department, a simple system that would easily be integrated into our department as a virtual private network (VPN) was selected. The system did not require any substantial hardware or software modifications. The resources allocated to the implementation of this project from our department included an IT representative and a staff physician.

Once the IMS was purchased, additional infrastructure, such as network drops, were installed at each imaging device location. Servers were installed in the temperature-controlled command IT data center. The vendor provided on-site verification of connectivity to each device. Each device was then integrated into the software system, and the hardware connections were re-verified. Within three weeks of installation, the IMS was fully operational and in use by over 21 providers and 20 ancillary staff, with minimal impact on our daily activities.

Providers were now able to access images and diagnostic data from each device through a secure web-based address that also provided historical data for comparison.

RESULTS

Since the implementation of an IMS, the ease of accessing and organizing patient imaging and diagnostic data from current and past encounters has dramatically improved. Prior to implementation, 1.5 minutes, at a minimum, was spent to walk from the patient exam room to the imaging system and back again. When multiple modalities were used it would require walking between multiple rooms and computers. This system has reduced that time to seconds, as it now only requires accessing a secure web site to review data without leaving the patient examination room. In addition, the provider can now educate the patient with the images provided. This constitutes a 10% increase in the amount of time spent with a patient for a typical 15-minute appointment. Our department has over 3500 patient encounters per month, translating into over 80 hours in time savings per month for providers. If a patient has multiple data sets gathered during a single appointment, which is not infrequent, there would be a significant increase in time savings.

In addition to improved efficiency, we have seen a significant savings in expenditures for printer ink cartridges, which will easily be sustained long-term, as noted in Table 1. Other cost savings include that of printer paper, paper record keeping, and record storage and archiving. Unseen savings are those associated with fewer visits per patient and improved outcomes that result from immediate access to all studies simultaneously.

Staffing levels required for administrative tasks per patient encounter have been re-adjusted and re-directed to direct patient care related activities. For example, in the past, a staff member would prepare shadow records on the day prior to the visit. After the encounter, images would need to be printed, scanned and associated with the correct patient encounter. The provider would then need to re-open the encounter in the electronic health record and verify the scanned document. The printed documents would then either be integrated into a shadow file or manually fed through a shredder. With the integration of an IMS, the ancillary staff member now participates in direct patient care related activities, such as vision screening, intraocular pressure measurements and refraction. Images are stored in a secure electronic database on a central server and can be accessed from any workstation in the department, eliminating the need for shadow records. Integration of images requires a simple copy and paste from the IMS into the electronic record, thus eliminating the need for scanning paper printouts.

CONCLUSION

In the era of electronic health records, along with the need to maintain a high standard of patient care, maintain information privacy, improve efficiency and provide coordination of care between multiple treatment areas and facilities, the use of an IMS is an innovative tool for a high volume medical image technical departments, such as an Ophthalmology Department. It is adaptable to all imaging devices and has universal applicability for all Department of Defense Ophthalmology Departments.

The implementation of an IMS into the NMCSD Ophthalmology Department has provided immediate and easily recognizable benefits to both patient care and staff satisfaction. The amount of time spent outside the examination room during a patient encounter has decreased by making the data accessible to the physician in the patient exam room. The cost of operating our imaging modalities has also been offset by future productivity gains and improved patient care at the chair-side. We believe that an image management system can easily be implemented by all Ophthalmology Departments across the Department of Defense and Veteran's Administration as an "off-the-shelf" system that is easy to install and meets the needs of all busy ophthalmology services.

Table 1: Printer Cartridge Costs and Savings			
Cartridge	**Frequency of replacement**	**Cost per unit**	**Cost per year**
Photo printer	Every three months	$600	$2400
Black laser printer	Every 550 pages or every 6 weeks	$24	$208
Color laser printer	Every 750 pages or every 7.5 weeks	$76	$526
		TOTAL	**$3134**

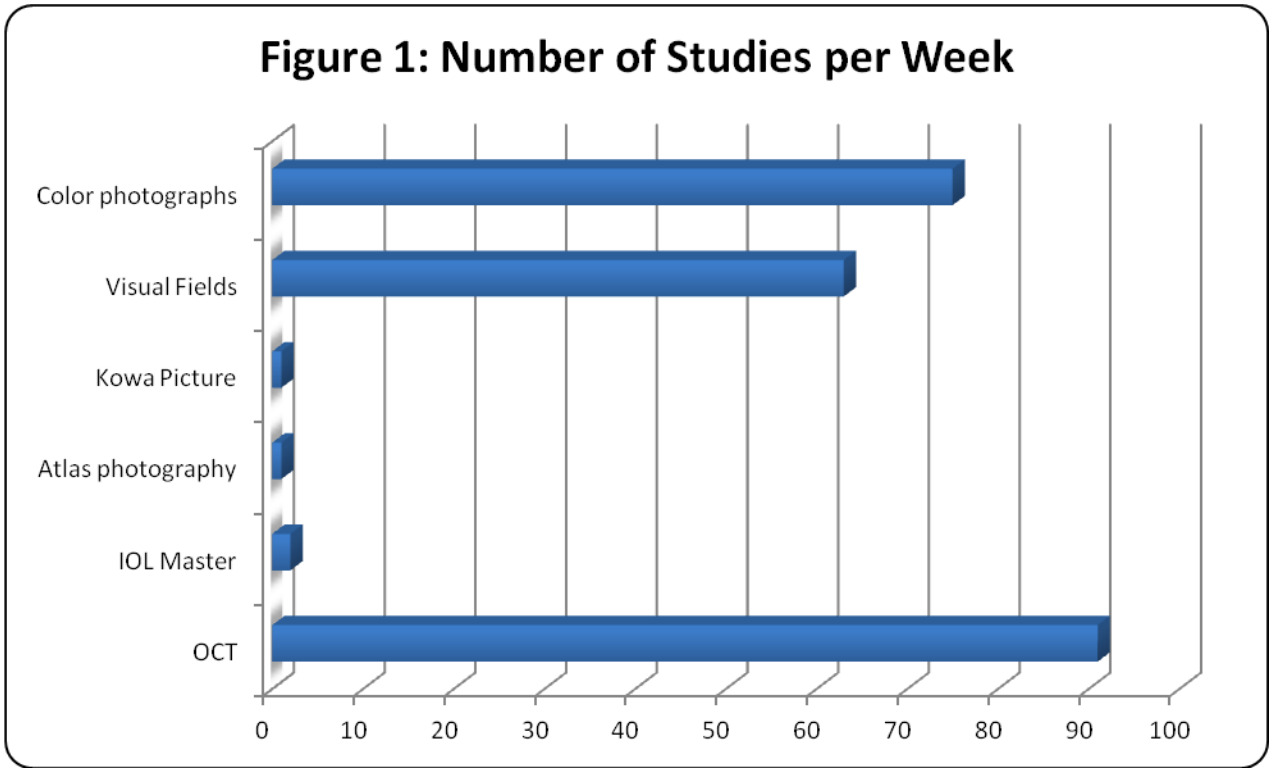
Figure 1: Number of Studies per Week
Color photographs
Visual Fields
Kowa Picture
Atlas photography
IOL Master
OCT
0
10
20
30
40
50
60
70
80
90
100

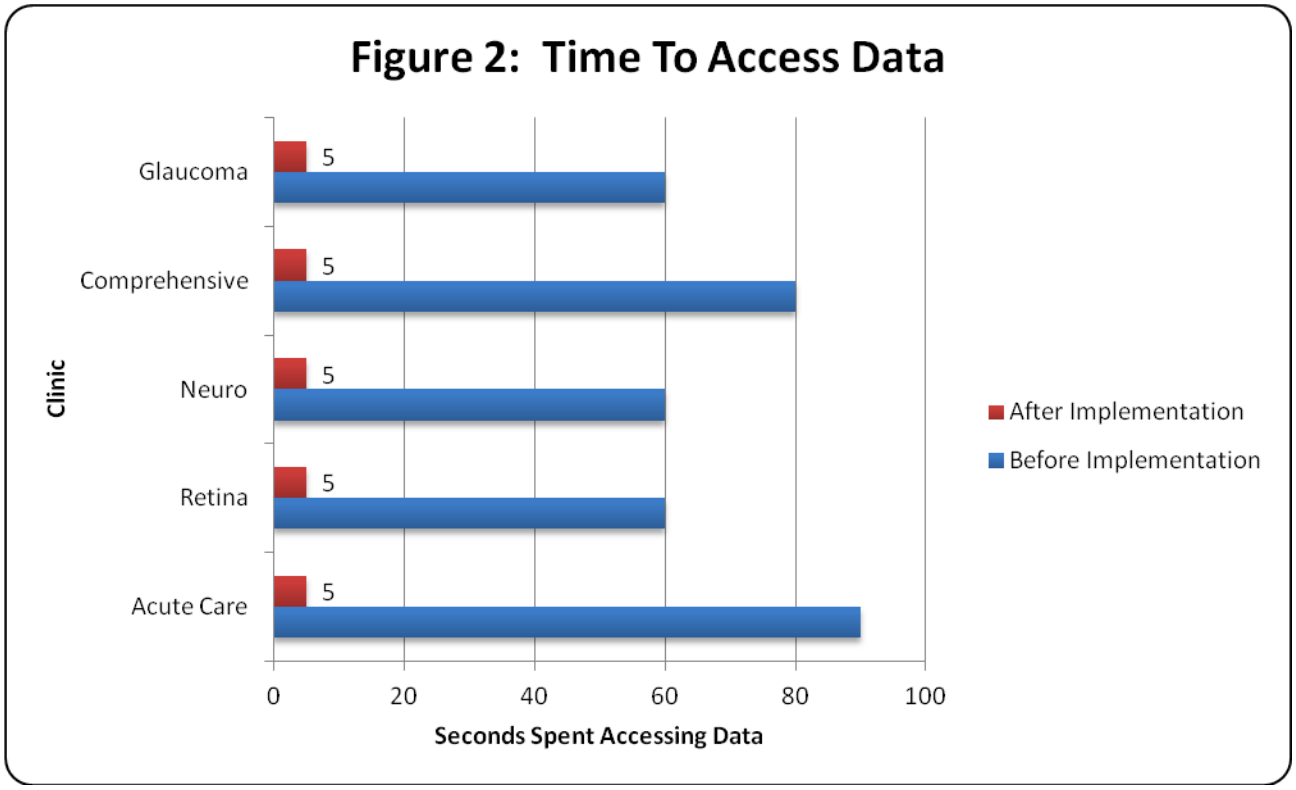
Figure 2: Time To Access Data
Glaucoma
Comprehensive
Neuro
Retina
Acute Care
5
5
5
5
5
Clinic
0
20
40
60
80
100
Seconds Spent Accessing Data
After Implementation
Before Implementation